

are totally different from those of adult worms. It is only exceptionally that such larvæ can be reared, in aquaria, to adults, and their identity definitely established. In many cases the larvæ do not present clear specific or even generic characters, and they can therefore be referred only to their respective families. The author has written a careful and detailed account, in most cases drawn from living specimens, of the principal larval forms captured, some of which have not been previously described. Measurements are given of the length and diameter of the larvæ, of some of the parapodia and setæ, and of the cilia; and the colour markings are recorded. The larvæ dealt with are as follows:—three Syllids, several Polynoids, three Phyllodocids (including Mystides and probably Eulalia), Nephthys, Spio, and four other Spionids, one of which is possibly the larva of the elusive Pœcilo-chætus, Polydora, and two other Polydorids, Magelona, Chætopterus, and Pectinaria, the metamorphosis, to the young adults, of the metatrochophoral larva of the last-named being described. The account of these larvæ, which is illustrated by means of forty-seven figures, will be welcome to many workers on plankton and on polychæts, and, although it is admittedly a preliminary account, it forms a good basis on which to found future observations. The reader is referred for a definition of the numerous technical terms employed in describing the different stages and larval organs to a recently published paper by the same author, but it would have been a considerable advantage and convenience to the reader if brief definitions of these terms had been given at the beginning of the present memoir.

We suggest to the editor of these memoirs that all the volumes published in the future be provided with a table of contents.

ENGINEERING SCIENCE.

- (1) *Applied Mechanics, Embracing Strength and Elasticity of Materials, Theory and Design of Structures, Theory of Machines and Hydraulics. A Text-book for Engineering Students.* By Prof. David Allan Low. Pp. vii+551. (London: Longmans, Green and Co., 1909.) Price 7s. 6d. net.
- (2) *Strength of Material: an Elementary Study prepared for the Use of Midshipmen at the U.S. Naval Academy.* By H. E. Smith. Second edition. Pp. ix+170. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1909.) Price 5s. 6d. net.
- (3) *Stresses in Masonry.* By H. Chatley. Pp. viii+142. (London: C. Griffin and Co., Ltd., 1909.) Price 3s. 6d. net.

(1) THE subject covered by this book is a very extensive one, and the author is to be congratulated on the fact that by judicious compression, without sacrifice of clearness, he has in a volume of only 550 pages covered ground to which usually two or three bulky text-books are devoted. No student can expect, however, to make himself master of the contents of the book unless, as the author himself suggests in his preface, he works conscientiously

through the sets of carefully thought-out problems which are given at the end of each chapter. At the end of the first, or introductory, chapter, Prof. Low has given a fairly complete bibliography for the subject, confining himself to works in the English language which have appeared during the last decade, or to those works which have been brought up to date by new and revised editions; this list will be found of considerable use by students who desire to extend their reading in any one branch of the subject.

The first five chapters are devoted to a series of introductory problems, work and energy, polygon of forces, moments and centroids, and for these latter both graphical and analytical methods are discussed; then follow six chapters on strength of materials. In the chapter dealing with compound strains and stresses, the opinion is expressed that in the case of ductile materials, such, for example, as mild steel, it is the resistance to shear which determines the strength, and reference is given to the experimental work of Guest, Hancock, Scoble, and others in investigating this problem. The whole of this chapter is well worth the careful study of the young engineer, who should not be content to leave it until he feels that he has made himself a thorough master of the principles laid down, and of the formulæ deduced for practical use in design work. Another chapter in this section which contains a well-arranged mass of information is that on the behaviour of materials in the testing machine; the latest memoirs have been summarised, and the conclusions to be drawn from these experimental investigations are clearly set forth.

In chapters xii. to xv. stress diagrams and the design of roofs and bridges are discussed, and, though of necessity there is much condensation, all the important points are clearly brought out. A student who has mastered this section will find that his work is much simplified when he comes to the study of one of the more advanced text-books specially devoted to this branch of engineering work.

The next eleven chapters are devoted to the subject of mechanism; such details as friction and lubrication, governors, toothed gearing, balancing of revolving and reciprocating masses, &c., are discussed in a satisfactory manner, and velocity and acceleration diagrams and crank effort diagrams receive due attention, though there is nothing novel in the method of treatment.

The last section of the book treats of hydraulics; the flow of water over weirs and through orifices and pipes, loss of head due to various causes, and the impact of jets on vanes are all in turn discussed, and the application of these principles to the design of such hydraulic machinery as water-wheels, turbines, pumps, and accumulators is then explained.

Prof. Low has succeeded in writing on a well-worn subject a text-book with many new features, and one which should find a place on the bookshelf of every young engineer.

(2) This small text-book was prepared for the use of the midshipmen at the U.S.A. Naval Academy in connection with one of the courses in the department of mathematics and mechanics. It deals, therefore,

only with the mathematical investigation of the subject; the experimental side is entirely omitted. The attempt to compress into one small table (p. 11) the average values of the tenacity, shearing strength, &c., of the chief materials of construction has led to the insertion of figures likely to mislead the unwary; for example, the tenacity of steel is given as 110,000 lb. per square inch; as a matter of fact, the tenacity of most of the mild steel used in constructional works lies between 60,000 and 70,000 lb. per square inch. Again, the shearing strength of wrought-iron is given as 20,160 lb. per square inch; this is much too low a figure; it is less than half the average value of the shearing strength of wrought-iron rivets and pins in double shear.

Each chapter has a series of examples to illustrate the formulæ which are deduced in that chapter, and the answers are in many cases appended; it is noticeable that these answers have a defect, by no means uncommon in text-books of this class, to which attention has often been directed, and which can best be explained by quoting a specimen answer. The student has to determine from certain data the diameter of a wooden spar used as a beam; the answer appended to the question is 7.0025 inches; of what value are the figures to the right of the decimal point? In a subject like strength of materials, one of the first lessons which the student should learn is that the numerical data which he proposes to use in some mathematical formula may, for obvious reasons, vary by some quite perceptible percentage on either side of a mean value (the value he proposes to use), and that, therefore, he can expect to obtain a solution which is only approximately correct, hence to work out a solution to the degree of accuracy of that in the example quoted above is not only a waste of time, but is positively misleading. It is to be hoped that in any future edition these answers will be revised.

The effect of combination of stresses is dealt with in chapter v. in a clear and simple fashion, and it is refreshing to find this portion of the subject taken up at such an early stage of the work, and its importance impressed upon the student.

The book concludes with a number of miscellaneous problems, such as reinforced concrete beams, stresses in thick cylinders and guns, &c.

The book will probably prove an acceptable one to young engineers who are just beginning the study of this important subject, and want to get a general insight into it before they begin to work at one of the more advanced and complete text-books.

(3) As the author points out, there are numerous elementary text-books on steel structural design, but there has been a distinct want of an elementary work on the design of masonry structures. This book will supply this need, for it explains just those underlying principles which the beginner finds it troublesome to understand.

It is difficult to follow the author's reasoning in chapter i., when deducing the safe compressive load for masonry; surely if it took 900 tons per square foot to crush a specimen of granite, there must have been a shearing stress when rupture occurred (most

probably by shearing) of something like 450 tons per square foot, and, therefore, the method of deducing a safe compressive working stress given on p. 10 is hardly logical.

The branches of masonry design dealt with include walls, piers, brackets, simple arches, vaults and skew arches, domes, and retaining walls and dams; the treatment of each branch is sufficiently complete for all the practical cases the young civil engineer or architect is likely to meet with, all the more complex theories being wisely omitted.

The last chapter deals in brief fashion with reinforced concrete, the essential principles of this system being fully explained.

POPULAR NATURAL HISTORY.

- (1) *Animals and their Ways. An Introduction to the Study of Zoology and Agricultural Science.* By E. Evans. Pp. viii+184. (London: J. M. Dent and Co., 1909.) Price 1s. 4d.
- (2) *The Hedge I Know.* Edited by W. P. Westell and H. E. Turner. Pp. 77. (London: J. M. Dent and Co., 1909.) Price 8d.
- (3) *The Pond I Know.* Edited by the same. Pp. 78. (London: J. M. Dent and Co., 1909.) Price 8d.
- (4) *Butterflies and Moths shown to the Children.* By Janet H. Kelman, described by Rev. Theodore Wood. Pp. xvi+94. (London and Edinburgh: T. C. and E. C. Jack, 1909.) Price 2s. 6d. net.
- (5) *Nests and Eggs shown to the Children.* By A. H. Blaikie, described by J. A. Henderson. Pp. xvi+78. (London and Edinburgh: T. C. and E. C. Jack, 1909.) Price 2s. 6d. net.
- (6) *The Backwoodsmen.* By Charles G. D. Roberts. Pp. 317. (London: Ward, Lock and Co., 1909.) Price 6s.

(1) **ALTHOUGH** the title of this review of the above series of books might lead one to suppose that this book would be a popular account of the lives and habits of animals, it is unfortunately necessary to point out that such an idea would be fallacious. It is a matter of regret that the author should have chosen a title which, to our minds, does not convey a correct idea of the contents. The reason may be that we have been spoilt by the previous publication of one or two excellent little works on animal life, and that our criterion has been raised. Be this as it may, the author has not succeeded in doing justice to his theme, and we cannot imagine any young student being filled with enthusiasm for zoological science, still less agricultural science, after having had this introduction. That the author must be a botanist is evinced by such a word as "Crustaceæ" (p. 170). The illustrations are poor, Fig. 3 being especially crude; and an acknowledgment of the source of such figures as are taken from the publications of the U.S. Department of Agriculture, which are good, should surely be given under the figures, as is customary.

(2 and 3). These small books of the same series are marvellous examples of cheap printing, and are unaccompanied by the usual inferior illustrations; they are well illustrated, and, on the whole, are written in simple language. It probably would have been pre-